TEST GEAR DEPARTMENT B2DC-32

TF 1073A

R.F. Attenuator

INSTRUCTION MANUAL

MP MASTER
MA23683

MARCONI INSTRUMENTS LIMITED

EB 1073
SUPP. A
1 - 4/59

SUPPLEMENT TO

OPERATING AND MAINTENANCE HANDBOOK

for

100-dB STEP ATTENUATOR

TYPE TF 1073

The Attenuator with which this handbook is issued is fitted with 75-ohm BNC connectors in place of Joint-Service Style PR4E and SR4G.

M.I. Ltd.

OPERATING AND MAINTENANCE HANDBOOK

for

100-dB STEP ATTENUATOR

TYPE TF 1073

CONTENTS

1. DESCRIPTION — Pages 4 & 5.

GENERAL.....Sect 1.1.
DESIGN DETAILS.....Sect 1.2.

2. OPERATION — Pages 6 & 7

INPUT AND OUTPUT SOCKETS - SUITABLE CABLES.Sect 2.1.
CONNECTING SOURCE TO ATTENUATOR INPUT.....Sect 2.2.
CONNECTING ATTENUATOR OUTPUT TO LOAD.....Sect 2.3.
GENERAL.....Sect 2.4.

3. MAINTENANCE — Pages 8 to 15

GENERAL.....Sect 3.1.
REMOVAL OF THE CASE.....Sect 3.2.
DISMANTLING THE ATTENUATORS.....Sect 3.3.
0- to 80-dB Attenuator.....Sect 3.3.1.
0- to 20-dB Attenuator.....Sect 3.3.2.
SCHEDULE OF TESTS.....Sect 3.4.
Apparatus Required.....Sect 3.4.1.
Attenuator Accuracy at D.C.....Sect 3.4.2.
Attenuator Accuracy at R.F.....Sect 3.4.3.

APPENDICES

COMPONENT LAYOUT ILLUSTRATIONS.....MP 1073-1-2
SPARES ORDERING SCHEDULE WITH CIRCUIT REFERENCES.....SOS/1073
FUNCTIONAL DIAGRAM.....TBX 23866
COMPLETE CIRCUIT DIAGRAM.....TCX 23558
TEST CIRCUITS.....TBX 25821
DECIBEL CONVERSION TABLE.....EB G-SUPP dB

SCHEDULE OF PARTS SUPPLIED

The complete equipment comprises the following items:-

1. One 100-dB Step Attenuator Type TF 1073.

2. Two Sockets, Free, Joint-Service Style SR4G; fitted with special cable-entry ferrules (M.I. Drg. Nos. TB23610/1 - /2) to accept double-screened cable.

3. One Operating and Maintenance Handbook No. EB 1073.

1. DESCRIPTION

1.1. GENERAL

The 100-dB Step Attenuator Type TF 1073 is a 75-ohm r.f. attenuator variable in 1-dB steps from 0 to 100 dB. It is direct reading without the use of correction charts, having a frequency characteristic sensibly flat well into the v.h.f. range. The maximum error at 100 Mc/s does not exceed 0.6 dB in 100 dB, and the performance is still quite acceptable up to 150 Mc/s.

Two separate sections in cascade form the basis of the attenuator; the degree of reduction of signal level through the sections is determined by the settings of two rotary controls calibrated in decibels. The first section has an attenuation range of 80 dB in 20-dB steps and the second a range of 20 dB in 1-dB steps; resistive networks of high accuracy are employed throughout. At minimum attenuation, the sections are switched to positions where a direct through connection is obtained with no shunt loading. Coaxial input and output plugs are provided for connection of the attenuator between source and load.

1.2. DESIGN DETAILS

The two attenuating sections comprising the 100-dB Step Attenuator are enclosed within separate screening covers contained in the outer case. The first, or 80-dB section, utilizes four successively-switched, additive, π-type networks, each of 20 dB. The second, or 20-dB section, contains twenty different networks producing, independently, attenuations from 1 to 20 dB in steps of 1 dB, only one network being in circuit for any given switch position; the 1-dB and 2-dB networks are of the T type, and the remaining eighteen are π networks.

The networks of both sections are switched so that clockwise rotation of the control knobs produces a decrease in attenuation, i.e., an increase in output; in this respect, the controls

1.2. (continued)

function in a similar manner to those normally found on the attenuators of signal generators. At the fully-clockwise position of the switches, all the attenuating networks are completely withdrawn from circuit, leaving a direct connection between the input and output plugs; this condition presents an insertion loss which is low at v.h.f. and which becomes virtually zero at lower frequencies.

2. OPERATION

2.1. INPUT AND OUTPUT SOCKETS - SUITABLE CABLES

Connection is made to the Attenuator by means of coaxial Joint-Service Style PR4E input and output plugs mounted on the front panel. Two Joint-Service Style SR4G free sockets to mate with these plugs are supplied with the instrument; the sockets are fitted with special cable-entry ferrules to take a standard double-screened, 75-ohm, 22-μμF/ft cable such as Telcon PT1 YM. The cable-entry fitting on this type of socket is interchangeable with the coin-slotted cap on the back of the socket to allow conversion from side-entry to in-line cable connection. The small set-screw in the side of the socket may be removed to admit a piece of resin-cored solder for ease of soldering in the restricted space when fitting the cable.

2.2. CONNECTING SOURCE TO ATTENUATOR INPUT

When connecting the source to the input of the Attenuator, the connecting cable should be kept as short as possible; it is recommended that the length of cable should not be more than 10 inches. Furthermore, it is important that the inner and outer screens of the cable, as well as being shorted together by the entry fittings on the socket at the Attenuator panel, should also be shorted together and earthed at the source end of the cable.

Although symmetrical networks are used, the input and output connections must not be reversed or earth currents flowing in the chassis may introduce serious errors.

2.3. CONNECTING ATTENUATOR OUTPUT TO LOAD

It is advisable, if accurate results are to be obtained, to make sure that the output lead is correctly terminated in a 75-ohm resistive load. This applies particularly when high-frequency

2.3. (continued)

measurements are being made, because any significant mismatch may set up standing waves in the output cable so that the impedance presented to the output socket is seriously different from 75 ohms and has a considerable reactive component. This effect can be minimized by keeping the output lead as short as possible.

The above precaution becomes very important in the special case where the impedance of the source feeding the attenuator is not 75 ohms and the attenuator setting is such that only one pad is in circuit, i.e., when the setting is 20 dB or less. Under these conditions, the image impedance at the output plug of the attenuator is not 75 ohms, so that, if the load resistance is also other than 75 ohms, the output cable is not correctly terminated at either end.

2.4. GENERAL

The total attenuation in decibels is the sum of the settings of the two switch controls. When both controls are set to 0 dB, the insertion loss of the Attenuator is less than 0.5 dB at frequencies up to 100 Mc/s.

Input powers up to a maximum of 0.25 watt may be applied to the Attenuator. This represents a level of over 4 volts r.m.s. at 75 ohms.

The instruments stands upright, for economy of bench space, but the case is fitted with a carrying handle which swings down to support the instrument in a sloping position if so desired.

3. MAINTENANCE

3.1. GENERAL

The following items (for details, see APPENDICES, Page 16) are included in this handbook to assist in the maintenance of the 100-dB Step Attenuator:-

Functional Diagram
Complete Circuit Diagram
Component Layout Illustrations
Spares Ordering Schedule

Before commencing the adjustment or replacement of component parts of the instrument, it is recommended that the user should familiarize himself with the details of design given in Section 1, DESCRIPTION, and illustrated in the Functional Diagram.

The Circuit Diagram shows all the electrical components contained in the instrument. The description of these components - their type, value, rating, etc. - is given in the Spares Ordering Schedule; the Schedule also lists certain selected mechanical components.

The physical location of the electrical components is shown on the Component Layout Illustrations.

3.2. REMOVAL OF THE CASE

To gain access to the interior of the instrument, first detach the two pivot bolts about which the anodised handle rotates; the handle may then be removed by springing out its side arms. Next, extract the 2-BA screw from the chromium plate on the base of the instrument; finally, remove the rear section of the case by giving it a light tap in the rearward direction with the palm of the hand.

3.3. DISMANTLING THE ATTENUATORS

3.3.1. 0- to 80-dB Attenuator

The 0- to 80-dB attenuator is a totally-enclosed sub-assembly. To gain access to its interior, the most practicable and satisfactory course is to first detach it from the front panel. To do this:-

(1) Remove the control knob after slackening the two grub-screws which secure the knob to the switch spindle.

(2) Detach the two 6-BA cheese-headed screws thus exposed and also the nut securing the switch spindle to the insulating panel.

(3) Remove the INPUT 75 Ω plug, if deemed necessary for ease of maintenance, by removing the nut securing the plug to the front panel.

With the attenuator freed from the front panel, its screening covers can now be removed as follows:-

(1) Slacken the four 6-BA cheese-headed screws which secure the flat plate to the main body of the attenuator.

(2) Remove the studding which passes through the centre of the two parallel sides of the U-shaped screening cover.

(3) Unscrew the fourteen self-tapping screws located at the ends of the main body of the attenuator and remove the U-shaped screening cover.

To replace the attenuator, the above procedure should be reversed. When re-assembling the attenuator, particular care should be taken to ensure (i) that the flanges of the U-shaped

3.3.1. (continued)

screening cover are inserted between the main body of the attenuator and the foil underneath the flat screening plate and not between the foil and the flat plate, (ii) that the studding which passes through the two parallel sides of the U-shaped screening cover is as tight as possible to maintain good screening between the individual sections of the switch, and (iii) that the two 6-BA screws and the spindle nut securing the main body of the attenuator to the insulating panel do not touch the case.

3.3.2. 0- to 20-dB Attenuator

The 0- to 20-dB attenuator is also a totally-enclosed sub-assembly. Partial access to the interior may be gained by removing its rear screening cover. To gain complete access to the interior of the attenuator, it is necessary to detach the whole sub-assembly from the front panel. To do this:-

(1) Remove the control knob after slackening the two grub-screws which secure the knob to the switch spindle.

(2) Unscrew the three instrument-headed screws thus exposed.

(3) Remove the OUTPUT 75 Ω plug, if deemed necessary for ease of maintenance, by removing the nut securing the plug to its insulating panel.

With the attenuator now free from the front panel, its front screening cover can be removed by extracting the three 2-BA countersunk screws which clamp the cover between the switch and the attenuator mounting plate.

To replace the attenuator, the above procedure should be reversed. When replacing the attenuator, make sure that the screens of its input and output cables do not touch the outer screening covers of the attenuator.

3.4. SCHEDULE OF TESTS

The sections which follow give a range of tests by which the main points of the performance of the TF 1073 can be checked and are based on abstracts from the internal Factory Test Schedule TS 1073.

The method normally employed in the factory is to measure the accuracy of attenuation at d.c. and also at frequencies in the v.h.f. range, finally measuring the insertion loss at some frequency as near to the upper limit of 100 Mc/s as is convenient. By using the d.c. test circuits suggested, a check on the accuracy of the input and output resistances is automatically obtained.

3.4.1. Apparatus Required

(a) Dry Battery, 3 volt.

(b) Standardized Resistance Box, 0 to 20 kΩ.

(c) Standard Resistor, 1000 Ω ±0.1%.

(d) Standard Resistor, 100 Ω ±0.1%.

(e) Two Standard Resistors, 75 Ω ±0.1%.

(f) Sensitive Centre-Zero Galvanometer, 10 mm/μA or better.

(g) R.F. Source.)
) For details, refer to Section 3.4.3.
(h) Receiver.)

3.4.2. Attenuator Accuracy at D.C. (Apparatus Required:- Items a to f)

(a) 0- to 20-dB Attenuator

This unit can be checked at d.c. by means of the circuit shown in Fig. 1 of Drawing No. TBX 25821 supplied with this handbook.

3. 4. 2. (continued)

Having connected the test circuit as shown in the diagram, the test procedure is as follows:-

(1) Set the 0- to 80-dB control to 0 dB and the 0- to 20-dB control to 1 dB.

(2) Adjust the resistance box to produce zero deflection on the galvanometer.

(3) Calculate the actual attenuation from the expression

$$\text{Attenuation (in decibels)} = \left(20 \log_{10} \frac{R + 1000}{1000}\right) - 6$$

Where R is the value of the variable resistance at balance. The actual value of attenuation should be 1 dB ±0. 1 dB.

(4) Repeat (2) and (3) above for the remaining nineteen positions of the switch; the actual attenuation should be within ±0. 1 dB of the nominal value for all switch positions.

(b) 0- to 80-dB Attenuator

This unit can be checked by means of the circuits shown in Figs. 2 and 3 of Drawing No. TBX 25821. As indicated in the diagrams, each step is checked individually as opposed to measuring the overall attenuation at each switch position; the total attenuation for any switch position is obtained by adding the individual attenuation values. The test procedure is as follows:-

(1) Remove the 0- to 80-dB attenuator from the case as described in Section 3. 3. 1.

(2) Set the 0- to 20-dB control to 0 dB and the 0- to 80-dB control to 80 dB (fully counter-clockwise).

3. 4. 2. (continued)

(3) Connect up the test circuit as shown in Fig. 2 of TBX 25821. The lead from the negative terminal of the battery and the lead from the bottom end of the 100-ohm resistor are shown connected separately to the frame or chassis of the 0- to 80-dB unit; this excludes from the measurement circuit any potential developed by the main battery current at the point where it leaves the 0- to 80-dB unit.

(4) Adjust the resistance box to produce zero deflection on the galvanometer.

(5) Calculate the actual attenuation from the expression

$$\text{Attenuation (in decibels)} = \left(20 \log_{10} \frac{R + 100}{100}\right) - 6$$

where R is the value of the variable resistance at balance. The actual value of attenuation should be 20 dB ±0. 2 dB. Let this value of attenuation be value "A" (see part (c) of this Section).

(6) Remove the 75-ohm series resistor and make connection to the attenuator as shown in Fig. 3 of TBX 25821.

(7) Adjust the resistance box to produce zero deflection on the galvanometer.

(8) Calculate the actual attenuation from the expression

$$\text{Attenuation (in decibels)} = 20 \log_{10} \frac{R + 100}{100}$$

where R is the value of the variable resistance at balance. The actual value of attenuation should be 20 dB ±0. 2 dB. Let this value of attenuation be value "B" (see part (c) of this Section).

3.4.2. (continued)

(9) Repeat (7) and (8) above with the positive battery lead and the galvanometer lead connected across (i) R8 and (ii) R71. In both cases, the actual attenuation should be 20 dB ±0.2 dB. Let this value of attenuation be value "C" for the circuit including R8 and "D" for the circuit including R71.

(c) General

The overall limits of attenuation for the 0- to 80-dB Attenuator should conform to those given in Table 1 below.

TABLE 1

Switch Position	Actual Attenuation Obtained from	Overall Attenuation Accuracy (dB)
20 dB	D	±0.2
40 dB	C+D	±0.4
60 dB	B+C+D	±0.5
80 dB	A+B+C+D	±0.5

The total cumulative error for any combination of settings of the two controls should not exceed (overall attenuation accuracy in Table 1) + (0.1 dB), e.g., the accuracy at 65 dB will be ±0.5 ±0.1 = ±0.6 dB.

3.4.3. Attenuator Accuracy at R.F. (Apparatus Required:- Items g and h)

During the factory calibration of the instrument, tests are made at two points within the r.f. range of the instrument; the points normally selected are 40 and 100 Mc/s. The tests performed

3.4.3. (continued)

are on attenuation accuracy and insertion loss and are carried out by means of a normal slide-back method in which the TF 1073 is interposed between (i) an r.f. source with a variable output attenuator and (ii) a receiver tuned to the particular frequency of test. The limits of attenuation error are the same as for d.c. (Section 3.4.2.) and the insertion loss with both controls at 0 should be less than 0.5 dB.

When testing the TF 1073 at r.f., it is advisable, if the results are to be of established accuracy, for both the r.f. source and the receiver to be matched to 75 ohms, otherwise standing waves in the connecting cables may introduce errors.

The output from the r.f. source should be variable, preferably by means of a continuously-variable control such as a piston attenuator; in the factory calibration procedure, a precision large-bore piston attenuator with a vernier scale giving an unusually high order of discrimination is employed. If such test apparatus is not available, then a signal generator such as Marconi TF 801B or TF 1066 can be used. Both these instruments have 50-ohm output circuits but they are readily adapted for 75-ohm working by means of a Matching Unit TM 4918. The piston attenuators in the TF 801B and TF 1066 are accurate to within 0.2 dB for incremental changes and they are thus adequate for checking that the performance of a TF 1073 is substantially correct.

APPENDICES

COMPONENT LAYOUT ILLUSTRATIONS

General View.....MP 1073 - 1

Interior Views.....MP 1073 - 2

SPARES ORDERING SCHEDULE WITH CIRCUIT REFERENCES.....SOS/1073

FUNCTIONAL DIAGRAM.....TBX 23866

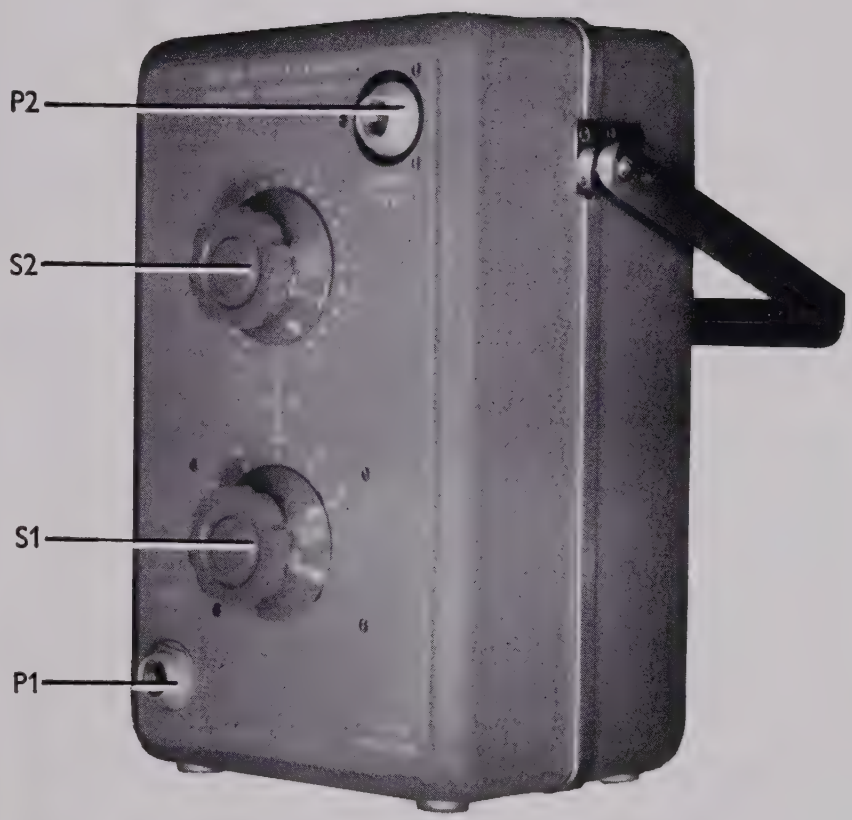
COMPLETE CIRCUIT DIAGRAM.....TCX 23558

TEST CIRCUITS FOR TF 1073.....TBX 25821

DECIBEL CONVERSION TABLE.....EB G-SUPP dB

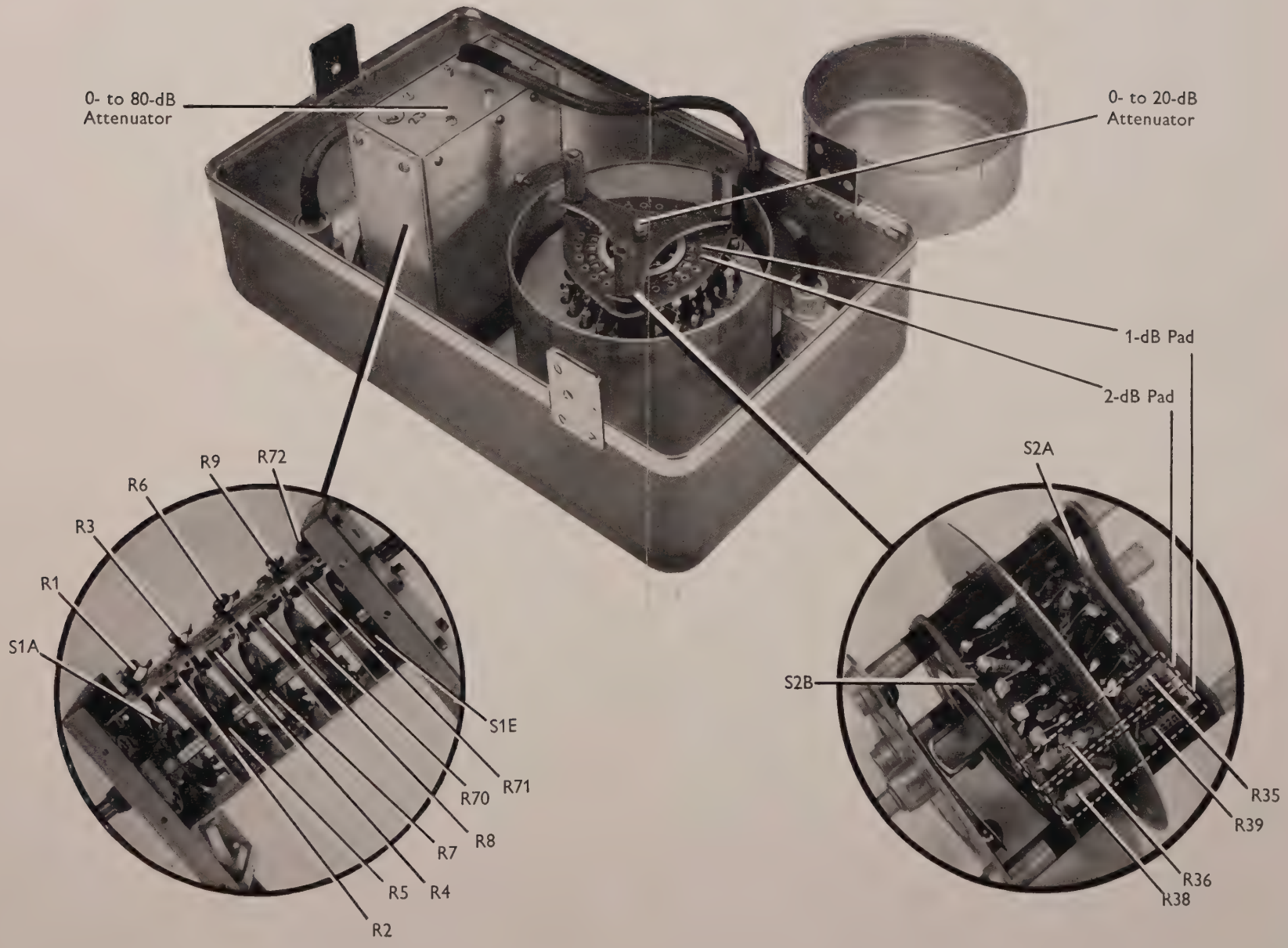
Sockets with special entry ferrules for double-screened coaxial cable

C.P. Ic-4/60



GENERAL VIEW

M.I. LTD. 2—3/56



INTERIOR VIEWS

SPARES ORDERING SCHEDULE NO. SOS/1073

WITH CIRCUIT REFERENCES

for

100-dB STEP ATTENUATOR TYPE TF 1073

Applicable to Instruments
Serial Nos:-

1865001 to 1865100
1953001 to 1953200
5127001 to 5127200
5233001 to 5233100
5255001 to 5255100
5348001 to 5348100
JA.50/001 to JA.50/200

When ordering replacement parts, ALWAYS QUOTE THE TYPE NUMBER AND SERIAL NUMBER OF THE INSTRUMENT CONCERNED.

To specify the individual parts required, STATE FOR EACH PART THE QUANTITY REQUIRED AND THE APPROPRIATE SOS ITEM NUMBER.

For example, to order replacements for the 371-Ω resistor, R2, and the 75-Ω Input Plug, P1, quote as follows:-

Spares required for TF 1073, Serial Number 000000

1 off, SOS Item 102
1 off, SOS Item 224

It is important that the code "SOS" preceding each item number should not be omitted.

SOS Item No.	Circuit Ref.	Description	Works Ref.
		RESISTORS (continued)	
118	R18	Carbon, High-Stability, 79.4 Ω ±1%, 1/8 W.	24-TM4924
119	R19	Carbon, High-Stability, 196 Ω ±1%, 1/8 W.	22-TM4924
120	R20	Carbon, High-Stability, 196 Ω ±1%, 1/8 W.	22-TM4924
121	R21	Carbon, High-Stability, 67.2 Ω ±2% 1/8 W.	21-TM4924
122	R22	Carbon, High-Stability, 225.5 Ω ±1%, 1/8 W.	19-TM4924
123	R23	Carbon, High-Stability, 225.5 Ω ±1%, 1/8 W.	19-TM4924
124	R24	Carbon, High-Stability, 56 Ω ±2%, 1/8 W.	20-TM4924
125	R25	Carbon, High-Stability, 268 Ω ±1%, 1/8 W.	18-TM4924
126	R26	Carbon, High-Stability, 268 Ω ±1%, 1/8 W.	18-TM4924
127	R27	Carbon, High-Stability, 45.7 Ω ±2%, 1/8 W.	17-TM4924
128	R28	Carbon, High-Stability, 332 Ω ±1%, 1/8 W.	16-TM4924
129	R29	Carbon, High-Stability, 332 Ω ±1%, 1/8 W.	16-TM4924
130	R30	Carbon, High-Stability, 35.8 Ω ±2%, 1/8 W.	15-TM4924
131	R31	Carbon, High-Stability, 439 Ω ±1%, 1/8 W.	14-TM4924
132	R32	Carbon, High-Stability, 439 Ω ±1%, 1/8 W.	14-TM4924
133	R33	Carbon, High-Stability, 26.45 Ω ±2%, 1/8 W.	13-TM4924
134	R34	Carbon, High-Stability, 323 Ω ±1%, 1/8 W.	12-TM4924
135	R35	Gold Sputtered, 8.6 Ω ±2%, 1/4 W.	10-TM4924

SOS Item No.	Circuit Ref.	Description	Works Ref.
		RESISTORS (continued)	
136	R36	Gold Sputtered, 8.6 Ω ±2%, 1/4 W.	10-TM4924
137	R37	Carbon, High-Stability, 650 Ω ±1%, 1/8 W.	11-TM4924
138	R38	Gold Sputtered, 4.32 Ω ±2%, 1/4 W.	9-TM4924
139	R39	Gold Sputtered, 4.32 Ω ±2%, 1/4 W.	9-TM4924
140	R40	Carbon, High-Stability, 371 Ω ±1%, 1/8 W.	48-TM4924
141	R41	Carbon, High-Stability, 91.6 Ω ±1%, 1/8 W.	49-TM4924
142	R42	Carbon, High-Stability, 91.6 Ω ±1%, 1/8 W.	49-TM4924
143	R43	Carbon, High-Stability, 330 Ω ±1%, 1/8 W.	46-TM4924
144	R44	Carbon, High-Stability, 93.9 Ω ±1%, 1/8 W.	47-TM4924
145	R45	Carbon, High-Stability, 93.9 Ω ±1%, 1/8 W.	47-TM4924
146	R46	Carbon, High-Stability, 293 Ω ±1%, 1/8 W.	44-TM4924
147	R47	Carbon, High-Stability, 96.6 Ω ±1%, 1/8 W.	45-TM4924
148	R48	Carbon, High-Stability, 96.6 Ω ±1%, 1/8 W.	45-TM4924
149	R49	Carbon, High-Stability, 260 Ω ±1%, 1/8 W.	42-TM4924
150	R50	Carbon, High-Stability, 99.8 Ω ±1%, 1/8 W.	43-TM4924
151	R51	Carbon, High-Stability, 99.8 Ω ±1%, 1/8 W.	43-TM4924
152	R52	Carbon, High-Stability, 230.5 Ω ±1%, 1/8 W.	40-TM4924
153	R53	Carbon, High-Stability, 103.3 Ω ±1%, 1/8 W.	41-TM4924

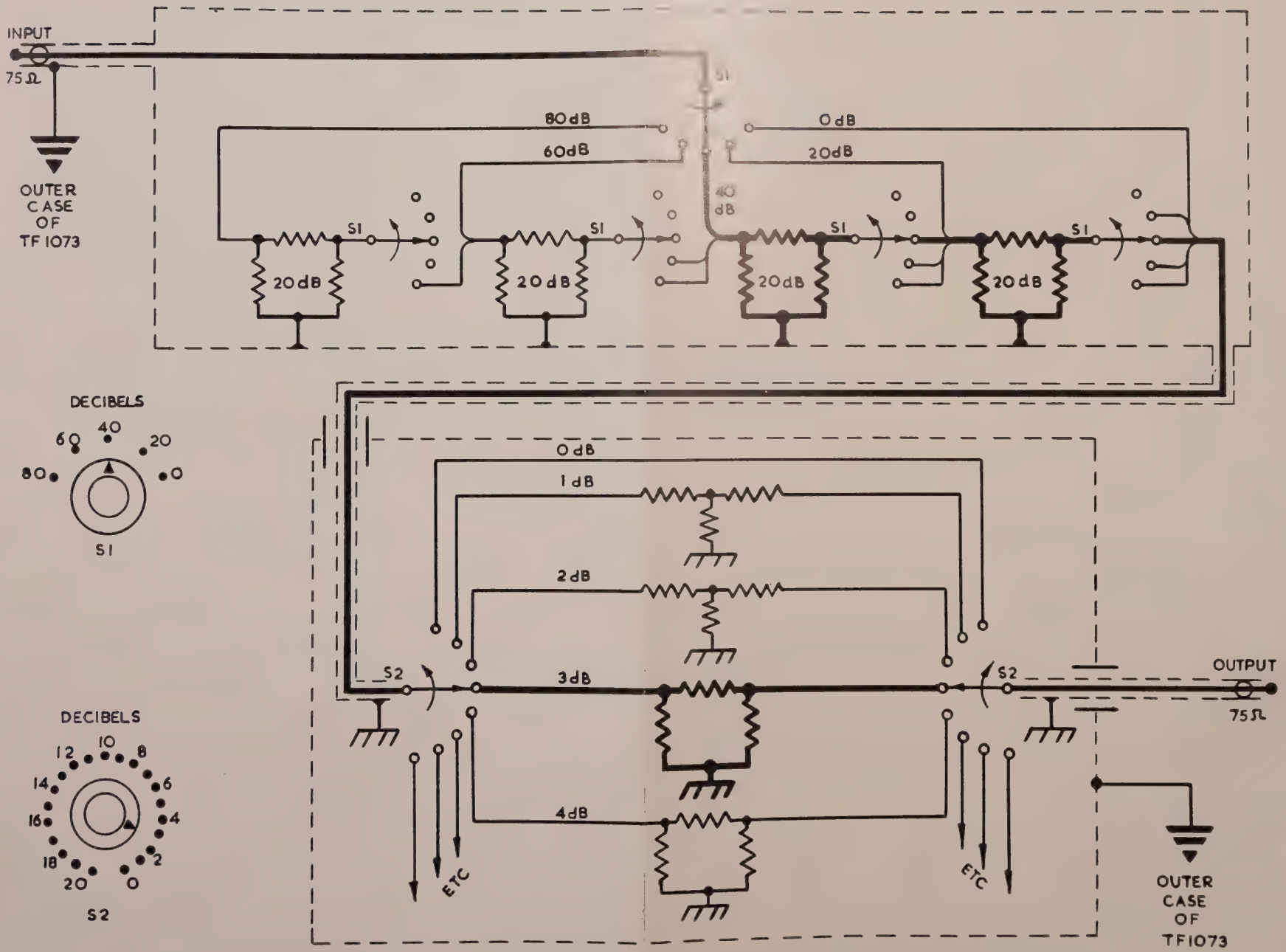
SOS Item No.	Circuit Ref.	Description	Works Ref.
		RESISTORS (continued)	
154	R54	Carbon, High-Stability, 103.3 Ω ±1%, 1/8 W.	41-TM4924
155	R55	Carbon, High-Stability, 204 Ω ±1%, 1/8 W.	38-TM4924
156	R56	Carbon, High-Stability, 107.4 Ω ±1%, 1/8 W.	39-TM4924
157	R57	Carbon, High-Stability, 107.4 Ω ±1%, 1/8 W.	39-TM4924
158	R58	Carbon, High-Stability, 180.5 Ω ±1%, 1/8 W.	36-TM4924
159	R59	Carbon, High-Stability, 112.4 Ω ±1%, 1/8 W.	37-TM4924
160	R60	Carbon, High-Stability, 112.4 Ω ±1%, 1/8 W.	37-TM4924
161	R61	Carbon, High-Stability, 159 Ω ±1%, 1/8 W.	34-TM4924
162	R62	Carbon, High-Stability, 118.3 Ω ±1%, 1/8 W.	35-TM4924
163	R63	Carbon, High-Stability, 118.3 Ω ±1%, 1/8 W.	35-TM4924
164	R64	Carbon, High-Stability, 139.7 Ω ±1%, 1/8 W.	32-TM4924
165	R65	Carbon, High-Stability, 125.4 Ω ±1%, 1/8 W.	33-TM4924
166	R66	Carbon, High-Stability, 125.4 Ω ±1%, 1/8 W.	33-TM4924
167	R67	Carbon, High-Stability, 122.4 Ω ±1%, 1/8 W.	30-TM4924
168	R68	Carbon, High-Stability, 134 Ω ±1%, 1/8 W.	31-TM4924
169	R69	Carbon, High-Stability, 134 Ω ±1%, 1/8 W.	31-TM4924
170	R70	Carbon, High-Stability, 91.6 Ω ±1%, 1/8 W.	18-TM4923
171	R71	Carbon, High-Stability, 371 Ω ±1%, 1/8 W.	17-TM4923
172	R72	Carbon, High-Stability, 91.6 Ω ±1%, 1/8 W.	18-TM4923

SOS Item No.	Circuit Ref.	Description	Works Ref.
		0- TO 20-dB ATTENUATOR	
201		Complete 0- to 20-dB Attenuator, including Items 202 to 209 and Resistors R10 to R69, but not including Item 210.	TM4924
202	S2	21-position switch wafer assembly included in Item 201.	TC 23495
203		Hexagonal pillars, set of three, to fit between Items 202 and 209; included in Item 201.	TB14097/96
204		Special feed-through insulators and nuts, set of two, for 1- and 2-dB pads; included in Item 201.	TB22663/1A TB22663/2
205		Coaxial cable, to connect Item 202 to Item 206; included in Item 201.	58-TM4924
206	P2	Coaxial OUTPUT 75 Ω plug with cable clamping nut and special ferrules for double-screened cable; included in Item 201.	52-TM4924 61-TM4924 TB23610/1 TB23610/2
207		Front screening cover; included in Item 201.	TC23483/1
208		Tapped mounting plate, secured to Item 207; included in Item 201.	TB23811
209		Rear screening cover; included in Item 201.	TC23483/2
210		Control knob for Item 201.	TB17848/10

SOS Item No.	Circuit Ref.	Description	Works Ref.
		0- TO 80-dB ATTENUATOR	
211		Complete 0- to 80-dB Attenuator, including Items 212 to 224 and Resistors R1 to R9 and R70 to R72, but not including Item 225.	TM4923
212	S1	5-position switch mechanism, switch wafers and set of spacers; included in Item 211.	TC4428/381
213		Internal screening plates, set of four, to fit between wafer sections of Item 212; included in Item 211.	TE22535/5A
214		Internal screening plate, complete with feed-through insulator to accept centre conductor of Item 223; included in Item 211.	TE22535/3
215		Internal screening plate through which connecting leads of R1, R3, etc., pass; included in Item 211.	TE22535/4A
216		End section (input); included in Item 211.	TE22535/1
217		End section (output); included in Item 211.	TE22535/2A
218		Earthing strip, earths spindle of Item 212 to Item 217; included in Item 211.	TE22535/6
219		Split-skirt earthing washers and retaining clips, set of two, earth spindle of Item 212 to Item 213; included in Item 211.	TB21990/1A TE22535/13
220		U-shaped outer screening cover; included in Item 211.	TE22535/9
221		Foil gasket, to fit between Item 222 and main body of attenuator; included in Item 211.	TE22535/10
222		Flat outer screening plate; included in Item 211.	TE22535/8

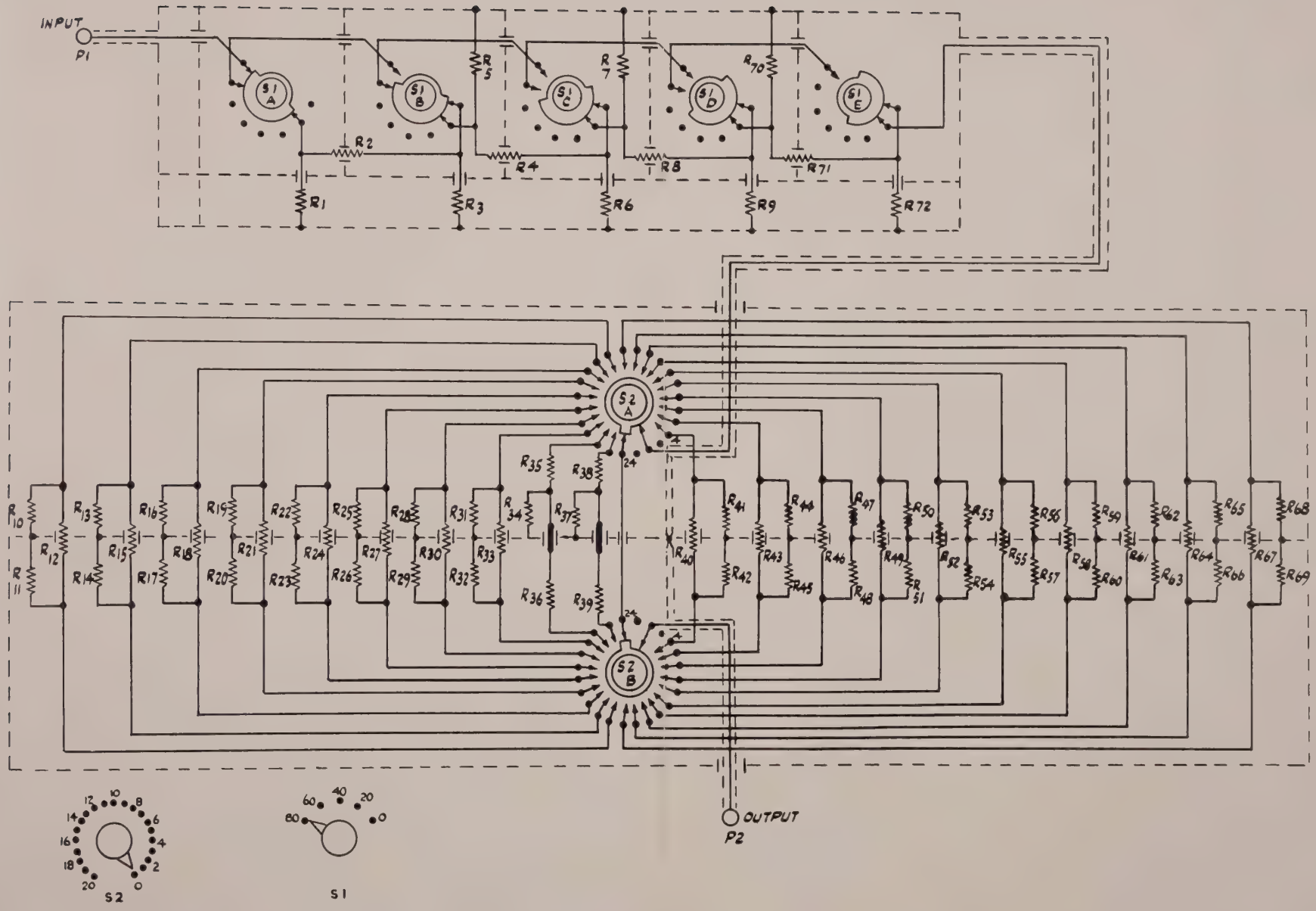
SOS Item No.	Circuit Ref.	Description	Works Ref.
		0- TO 80-dB ATTENUATOR (continued)	
223		Coaxial cable for input and output connections to attenuat or; included in Item 211.	29-TM4923
224	P1	Coaxial INPUT 75 Ω plug with cable clamping nut and special ferrules for double-screened cable; included in Item 211.	20-TM4923 35-TM4923 TB23610/1 TB23610/2
225		Control knob for Item 211.	TB17848/10
		OUTER CASE	
226		Case front section, includes Items 227 to 231.	TD23548
227		Anodized edging strip, three pieces; included in Item 226.	TC18240
228		Chromed handle-securing plate, right-hand; included in Item 226.	TA18738
229		Chromed handle-securing plate, left-hand; included in Item 226.	TA18738/1
230		Chromed base-securing plate; included in Item 226.	TA18738/2
231		Case feet, set of two; included in Item 226.	TA22919
232		Case rear section.	TE19724/2A
233		Case feet, set of four, for Item 232.	TA22919
234		Anodized carrying handle.	TB18736
235		Pivot bolts, set of two, for securing Item 234 to Items 228 and 229.	TB18737/1

SOS Item No.	Circuit Ref.	Description	Works Ref.
		MISCELLANEOUS	
236		Insulated mounting plate for Item 206.	TB23550/2
237		Insulated mounting plate for Item 211.	TB23550/1
238		Sockets, free, Joint-Service Style SR4G, set of two, with cable clamping nut and special ferrules for double-screened cable.	18-TF1073 21-TF1073 TB23610/1 TB23610/2
239		Operating and Maintenance Handbook.	EB 1073



FUNCTIONAL DIAGRAM

TLC 23866



CIRCUIT DIAGRAM

TLC 23558

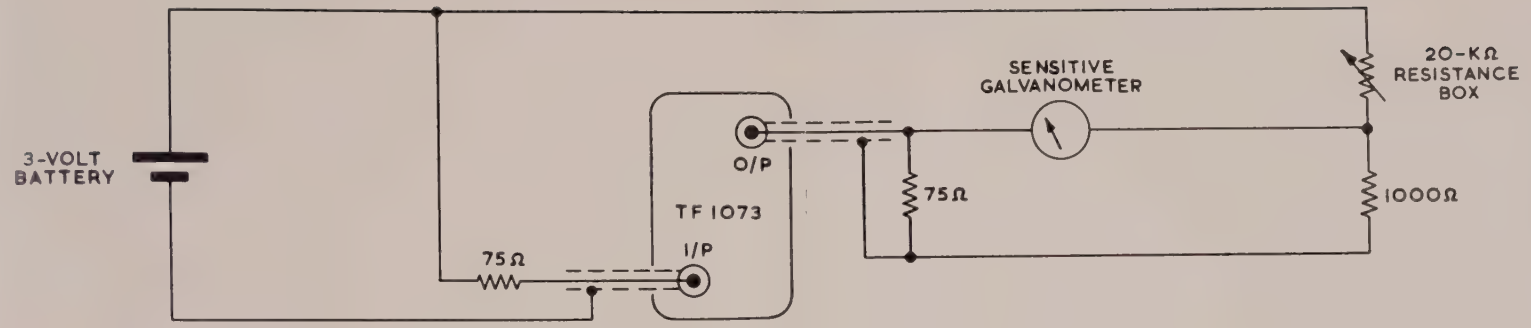


FIG 1

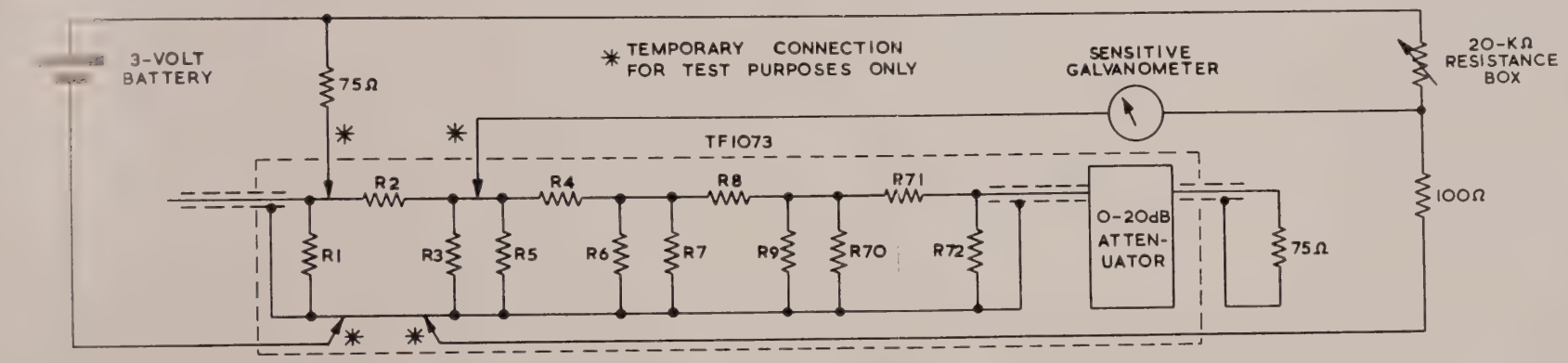


FIG 2

FOR ACTUAL LAYOUT OF COMPONENTS — SEE MP1073-2

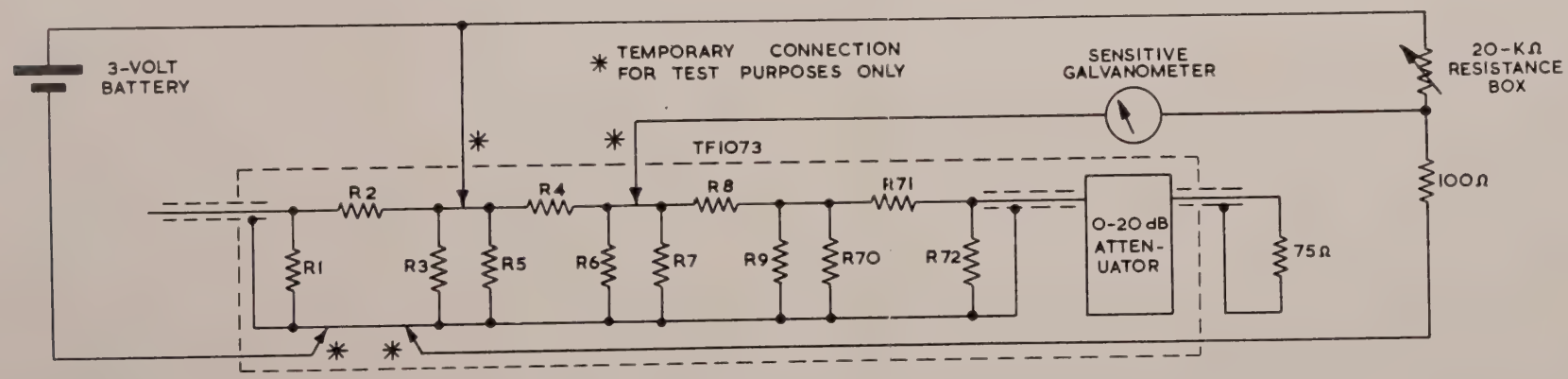


FIG 3

Fig. 1 Testing the 0– to 20–dB Attenuator

Fig. 2 Testing the 0– to 80–dB Attenuator (First Step)

Fig. 3 Testing the 0– to 80–dB Attenuator (Remaining Steps)

TEST CIRCUITS

DECIBEL CONVERSION TABLE

Ratio Down			*Ratio Up*	
VOLTAGE	*POWER*	*DECIBELS*	*VOLTAGE*	*POWER*
·1585	·02512	**16**	6·310	39·81
·1413	·01995	**17**	7·079	50·12
·1259	·01585	**18**	7·943	63·10
·1122	·01259	**19**	8·913	79·43
·1000	·01000	**20**	10·000	100·00
·07943	·006310	**22**	12·59	158·5
·06310	·003981	**24**	15·85	251·2
·05012	·002512	**26**	19·95	398·1
·03981	·001585	**28**	25·12	631·0
·03162	·001000	**30**	31·62	1,000
·02512	·0006310	**32**	39·81	1,585
·01995	·0003981	**34**	50·12	2,512
·01585	·0002512	**36**	63·10	3,981
·01259	·0001585	**38**	79·43	6,310
·01000	·0001000	**40**	100·00	10,000
·007943	·00006310	**42**	125·9	15,850
·006310	·00003981	**44**	158·5	25,120
·005012	·00002512	**46**	199·5	39,810
·003981	·00001585	**48**	251·2	63,100
·003162	·00001000	**50**	316·2	100,000
·002512	$6{\cdot}310 \times 10^{-6}$	**52**	398·1	158,500
·001995	$3{\cdot}981 \times 10^{-6}$	**54**	501·2	251,200
·001585	$2{\cdot}512 \times 10^{-6}$	**56**	631·0	398,100
·001259	$1{\cdot}585 \times 10^{-6}$	**58**	794·3	631,000
·001000	10^{-6}	**60**	1,000	10^{6}
·0005623	$3{\cdot}162 \times 10^{-7}$	**65**	1,778	$3{\cdot}162 \times 10^{6}$
·0003162	10^{-7}	**70**	3,162	10^{7}
·0001778	$3{\cdot}162 \times 10^{-8}$	**75**	5,623	$3{\cdot}162 \times 10^{7}$
·0001000	10^{-8}	**80**	10,000	10^{8}
·00005623	$3{\cdot}162 \times 10^{-9}$	**85**	17,780	$3{\cdot}162 \times 10^{8}$
·00003162	10^{-9}	**90**	31,620	10^{9}
·00001000	10^{-10}	**100**	100,000	10^{10}
$3{\cdot}162 \times 10^{-6}$	10^{-11}	**110**	316,200	10^{11}
10^{-6}	10^{-12}	**120**	10^{6}	10^{12}
$3{\cdot}162 \times 10^{-7}$	10^{-13}	**130**	$3{\cdot}162 \times 10^{6}$	10^{13}
10^{-7}	10^{-14}	**140**	10^{7}	10^{14}

DECIBEL CONVERSION TABLE

Ratio Down			*Ratio Up*	
VOLTAGE	*POWER*	*DECIBELS*	*VOLTAGE*	*POWER*
1·0	1·0	**0**	1·0	1·0
·9886	·9772	**·1**	1·012	1·023
·9772	·9550	**·2**	1·023	1·047
·9661	·9333	**·3**	1·035	1·072
·9550	·9120	**·4**	1·047	1·096
·9441	·8913	**·5**	1·059	1·122
·9333	·8710	**·6**	1·072	1·148
·9226	·8511	**·7**	1·084	1·175
·9120	·8318	**·8**	1·096	1·202
·9016	·8128	**·9**	1·109	1·230
·8913	·7943	**1·0**	1·122	1·259
·8710	·7586	**1·2**	1·148	1·318
·8511	·7244	**1·4**	1·175	1·380
·8318	·6918	**1·6**	1·202	1·445
·8128	·6607	**1·8**	1·230	1·514
·7943	·6310	**2·0**	1·259	1·585
·7762	·6026	**2·2**	1·288	1·660
·7586	·5754	**2·4**	1·318	1·738
·7413	·5495	**2·6**	1·349	1·820
·7244	·5248	**2·8**	1·380	1·905
·7079	·5012	**3·0**	1·413	1·995
·6683	·4467	**3·5**	1·496	2·239
·6310	·3981	**4·0**	1·585	2·512
·5957	·3548	**4·5**	1·679	2·818
·5623	·3162	**5·0**	1·778	3·162
·5309	·2818	**5·5**	1·884	3·548
·5012	·2512	**6**	1·995	3·981
·4467	·1995	**7**	2·239	5·012
·3981	·1585	**8**	2·512	6·310
·3548	·1259	**9**	2·818	7·943
·3162	·1000	**10**	3·162	10·000
·2818	·07943	**11**	3·548	12·59
·2512	·06310	**12**	3·981	15·85
·2239	·05012	**13**	4·467	19·95
·1995	·03981	**14**	5·012	25·12
·1778	·03162	**15**	5·623	31·62

MARCONI INSTRUMENTS LIMITED
ST. ALBANS, HERTS., ENGLAND

SERVICE DIVISION	**HEDLEY ROAD, ST. ALBANS, HERTS.** *Telephone: St. Albans 50731* (Ansafone)
HOME and EXPORT SALES OFFICES	**LONGACRES, ST. ALBANS, HERTS.** *Telephone: St. Albans 59292* *Telegrams: Measurtest, St. Albans* *Telex: 23350*
U.S.A.	**MARCONI INSTRUMENTS DIVISION OF ENGLISH ELECTRIC CORP., 111 CEDAR LANE, ENGLEWOOD, NEW JERSEY 07631** *Telephone: 201 567-0607*
BUNDESREPUBLIK DEUTSCHLAND	**MARCONI MESSTECHNIK GMBH, 8 MÜNCHEN-SOLLN, WOLFRATSHAUSER STRASSE 243** *Telefon: 79 78 50* *Fernschreiber: 05/24642*
FRANCE	**MARCONI INSTRUMENTS, SUCCURSALE DE FRANCE, 40 RUE DE L'AQUEDUC, PARIS Xe** *Téléphone: Paris 607 71-12 71-13*

WORLD-WIDE REPRESENTATION

MP MASTER

MA23683

Printed in England